

(12) **UK Patent Application** (19) **GB** (11) **2 212 725 A** (13)
 (43) Date of A publication 02.08.1989

(21) Application No 8727388.4

(22) Date of filing 23.11.1987

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(51) INT CL'
 A62B 18/02

(52) UK CL (Edition J)
 A5T TBA

(56) Documents cited
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(58) Field of search
 UK CL (Edition J) A5T TBA TCKA TCT
 INT CL' A62B

(54) Breathing apparatus

(57) A breathing apparatus for a person, has a face mask 1 arranged to at least partially support a pair of pressurised cannisters 6 containing a life support medium and a valve device 4 connected with the face mask 1 and the cannisters 6 for admitting the medium to a person wearing the face mask. The mask has pockets 5 to support the outer ends of the cannisters 6.

The cannisters are provided with a displaceable seal and in one embodiment the valve device is arranged to displace the seal of the cannisters to admit the medium to the face mask through a diaphragm and in another embodiment the seal of the cannisters is displaced when secured to the valve device and a rotatable valve is used to admit the medium to the face mask.

The breathing apparatus is intended to provide only a limited supply of life supporting medium for use, in, for example, an aircraft or ship accident situation.

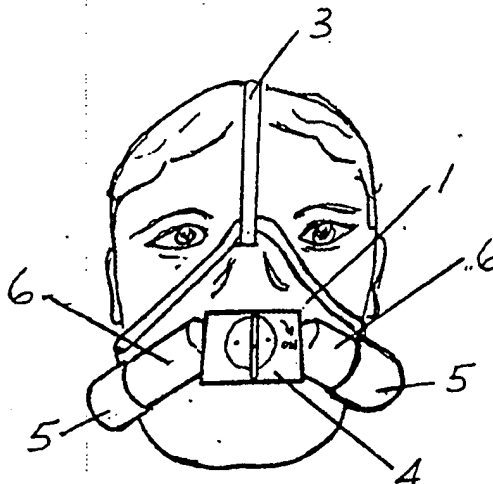


FIG. 1

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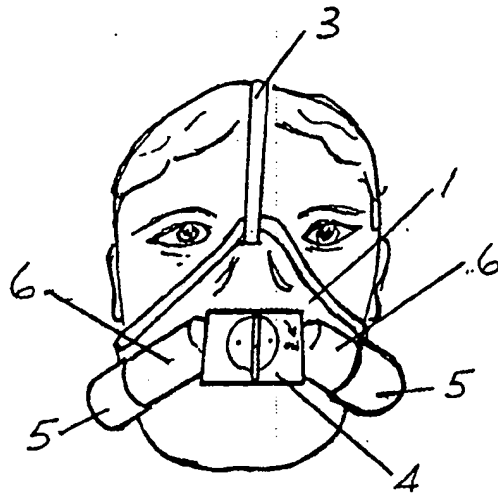


FIG. 1

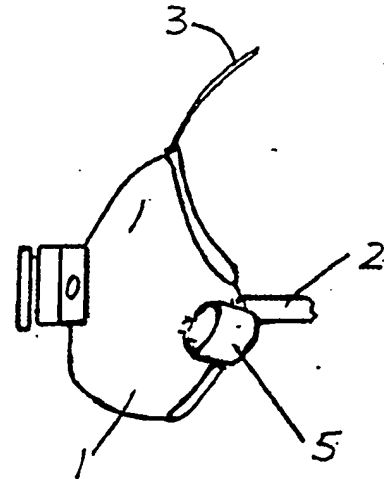


FIG. 2

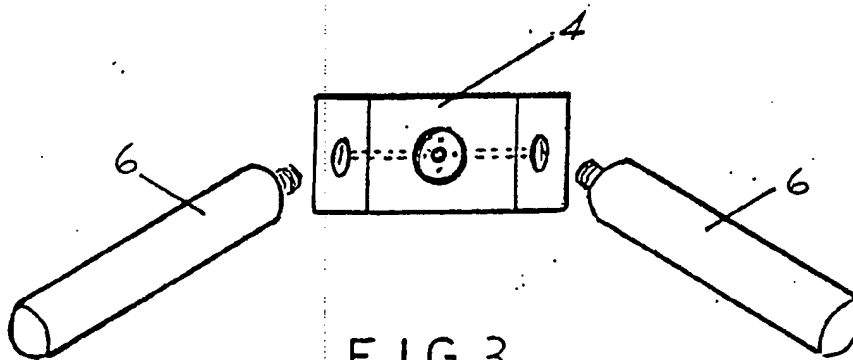


FIG. 3

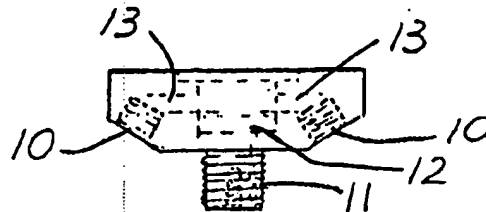


FIG. 4

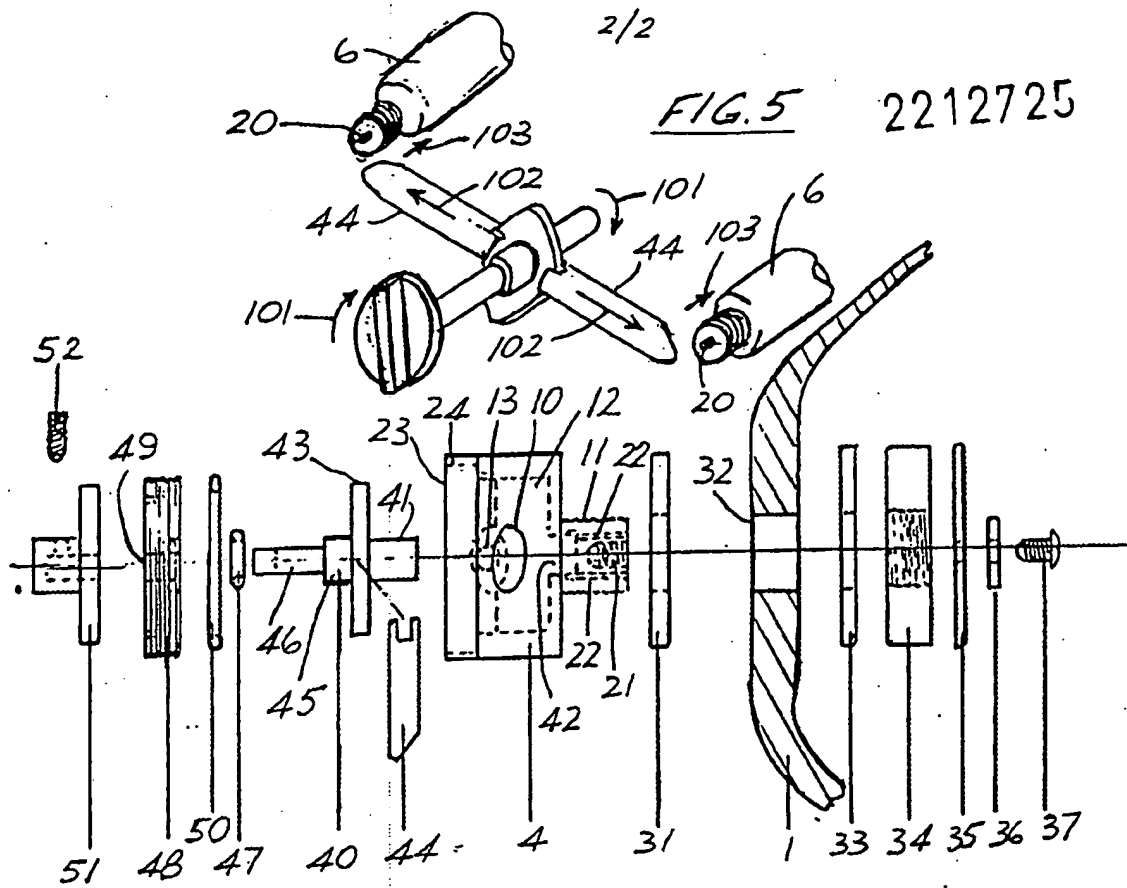


FIG. 6.

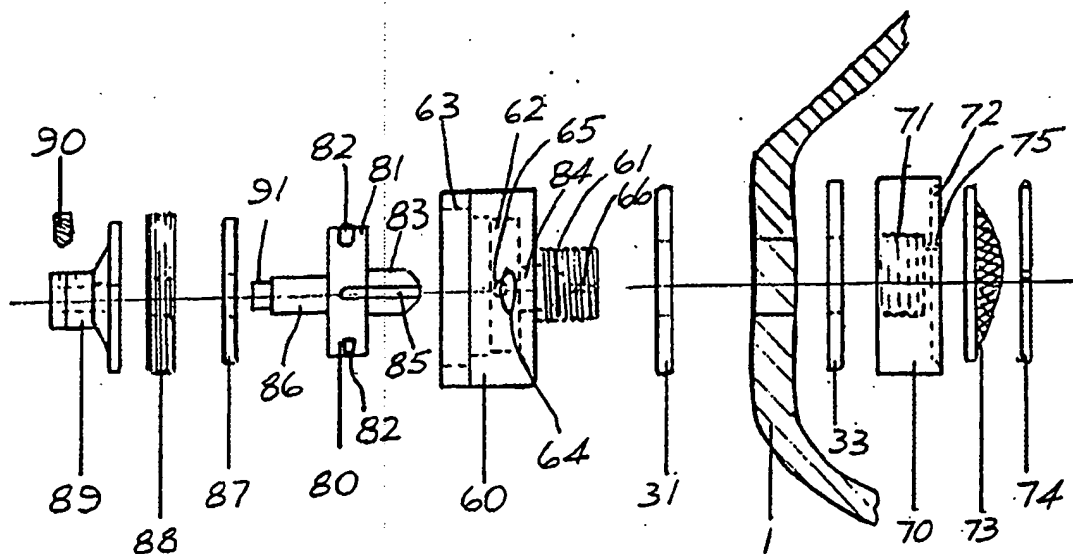


FIG. 7.

BREATHING APPARATUS

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This invention relates to a breathing apparatus and is particularly intended to provide such an apparatus which is able to provide a limited breathing support facility.

Statistics on fatalities from air and sea disasters show a high percentage of fatal injuries occur when an individual person is already unconscious. In aircraft accidents involving fire after a crash landing, inhalation of toxic fumes can render survivors incapable of self preservation action which could have saved life. Survivors of such accidents who have inhaled toxic gases are often condemned to severe and permanent lung damage resulting in the survivor being permanently crippled and often having a shortened life. In disasters at sea, it is considered that the first immersion, particularly in panic situations, causes inhalation of water to the lungs reducing the capability of survival, even though a life jacket performs the function of retaining a person's head above water.

In both situations it is extremely advisable for breathing apparatus to be provided, however existing types of breathing apparatus are bulky and generally intended for extended breathing support.

The present invention seeks to provide a breathing apparatus having a very limited breathing support facility, of, for example, three to four minutes, since it is believed that although being limited in time such an apparatus could dramatically increase the survival rate in both the instances of aircraft fire and initial immersion in water. The criteria for such an apparatus requires that it be simple to fit and operate, that it be self contained, does not hamper a survivor's ability to use hands and arms in attempts to free themselves, and it is of a low cost to enable transporting authorities and companies to supply the apparatus on the same basis as, for example, life jackets.

According to this invention there is provided a breathing apparatus for a person comprising a valve means arranged to at least partially support at least one pressurised cannister of a life supporting medium, said valve means also being arranged to support a face mask for admitting said medium to a person wearing said face mask.

Preferably said valve means is arranged to at least partially support a pair of cannisters, one on each side of said mask. Conveniently a pocket type aperture is provided on each side of said mask for receiving and additionally supporting a respective cannister.

Advantageously securing means are provided for attaching said face mask to a person.

Conveniently the valve means comprises a block member for receiving the cannisters in an air tight fashion, said block member 5 having means for supporting said face mask and a passageway extending from each cannister, provided in use, to said face mask, and an opening means for predeterminedly admitting said medium to the passageways. Conveniently said face mask is mounted on an integral boss of said valve means. Preferably said passageway is a Y-shaped configuration with the 10 arms of the Y extending to a respective cannister and the leg thereof extending to the face mask.

In one embodiment in which the cannisters are provided with a displaceable seal for permitting expulsion of said medium, the opening means comprises a manually rotatable member connected to rotate a pair of 15 cam driven members which, in operation, when driven by said cam are arranged to displace said seal whereby said medium is admitted to said passageways.

In another embodiment in which the cannisters continuously supply said medium to said block member, the opening means comprises a manually 20 rotatable member having a seal disposed for blocking said passageway, whereby upon rotation of said manually rotatable member the seals unblock the passageway and admit said medium to said face mask. In such an embodiment, preferably said manually rotatable member has a pair of channels each disposed between respective seals for providing a path for 25 said medium to said face mask.

Advantageously said life supporting medium is compressed air or oxygen.

Preferably means are provided to lock the valve means in a closed position so that the medium cannot be passed to said face mask until 30 manually unlocked. Conveniently the means for locking is a low breaking point wire arranged to normally prevent rotation of said manually rotatable member. In such an embodiment removal of the wire allows the manually rotatable member to cause the medium to be admitted through the passageway to said face mask on a continued bleed principle which fills 35 the mask with the medium, allowing free breathing for a short period and preventing the access to toxic fumes or water.

The invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 shows a front view of the breathing apparatus in accordance with this invention mounted in position on a person,

5 Figure 2 shows a side view of the breathing apparatus shown in Figure 1 but without the life supporting medium cannisters,

Figure 3 shows a rear view of a valve block with the life supporting medium cannisters disassembled,

Figure 4 shows a top plan view of the block shown in Figure 3,

10 Figure 5 shows a perspective view of part of a valve arrangement in accordance with one embodiment of the invention,

Figure 6 shows in partial cross-section an exploded side view of an apparatus in accordance with this invention utilising the valve arrangement of Figure 5, and

15 Figure 7 shows a partial cross-sectional exploded side view of another embodiment of the invention utilising a different valve arrangement.

The breathing apparatus shown in Figures 1 and 2 has a face mask 1 having side straps 2 and a strap 3 for extending over a person's head 20 which may be of any known design. e.g. elasticated, for speedy use for fitting the mask to a person. The face mask is made of pliable rubber or plastic having a nose and a mouthpiece. The mask 1 is secured to a valve block 4 and positioned on the mask at approximately the cheek positions of a person are a pair of pocket type apertures 5, one on each side of 25 the mask, for accepting and supporting a respective cannister 6 containing a life supporting medium such as compressed air or oxygen. The medium may be under a pressure of, for example, 100-150 psi and be of sufficient volume to hold a three to four minute supply of the medium.

Figure 3 shows a rear view of the valve block 4 shown in Figure 1 30 in which the face mask has been removed and if reference is also made to Figure 4 it will be seen that the block is generally rectangular with a pair of oppositely opposed angled faces in which is provided an internally screw-threaded aperture 10 into which a respective cannister 6, which are arranged to have an externally threaded portion, are allowed 35 to be matingly secured. The valve block 4 has an integral boss 11 on which is provided an external screw thread for attachment of the face mask and a primary opening 12, part of which acts as an expansion chamber, extends from one planar side of the block 4 through the boss 11.

A further passageway 13 extends between respective apertures 10 to the primary opening 12. The passageways 13 and opening 12 through the boss are thus in a Y-shape configuration.

Figures 5 and 6 show one embodiment of the invention in which the 5 cannisters 6 have an outwardly biased, of the cannisters, valve 20 whereby depression of the valve 20 permits the pressurised air or oxygen within the cannisters to be expelled.

The boss 11 is counter-bored to provide an internal screw thread 21. The primary opening 12 at its left hand end (as shown in Figure 6) 10 leads into a larger diameter bore 23 having an internally screw-threaded wall periphery 24. The right hand end of primary opening 12 has a blind bore portion 42 and two 0.003 inch passages 22 extend longitudinally through the boss 11 to communicate with the primary opening 12.

The face mask 1 is assembled on the valve block 4 by a sealing 15 washer 31 being positioned over the boss, an aperture 32 in the face mask being position over the boss, a further washer 33 similar to the washer 31 being positioned on the boss and an internally threaded locking washer 34 clamping the combination of washer 31, face mask 1 and washer 33 onto the valve block 4. A rubber diaphragm valve 35 having an aperture 20 therein and a sealing washer 36 are secured onto the block 4 by a screw 37 mating with the internal screw thread 21. The diaphragm valve 35 is arranged to lift on inhalation and on exhalation it presses forwardly.

A cam member 40 has a shaft 41 which rotates within the blind bore portion 42, a cam face 43 which is a double cam having major and minor 25 lobes. The cam face operates bars 44 which are slotted adjacent to the cam face to provide a secure connection therewith. The cam member 40 has a further shaft 45 and a shaft of reduced portion 46, the shaft 45 being a sealing fit with on O-ring 47. An externally threaded sealing plug 48, having an internal hole 49 which is an easy running fit over shaft 46, 30 holds the cam member 40 in the block 4 in an air tight fashion by an O-ring 50 being compressed between the plug 48 and an internal face of the block 4. Thus, by virtue of the O-rings 47 and 50 air or oxygen escape is prevented via the threads of plug 48 or the shaft 46. A control knob 51 is mounted on the shaft 46 and secured thereto by a grub screw 52.

The control knob 51 is arranged to operate only through a total movement of 90° and with the cannisters 6 in position the bars 44 are located on the minor lobe position of cam face 43. The control knob 51 is maintained in such an OFF position by a frangible wire forming a lock 5 (not shown). To operate the breathing apparatus the frangible lock is broken and the control knob turned through 90° as shown by arrow-headed lines 101 to drive the bars 44 outwardly as shown by arrow-headed lines 102 by virtue of cam face 43, the bars moving to the major diameter lobe position of the cam and in so moving depress the valve 20 of the 10 cannisters as shown by arrow-headed lines 103. Depression of the valve 20 to an ON position allows air or oxygen contained in the cannisters to bleed into the primary opening 12 through passageway 13 and, via the demand diaphragm valve 35, through holes 22 into the face mask.

The air or oxygen from the primary opening 12 is admitted to the 15 face mask 1 by the diaphragm valve 35 opening and closing the holes 22 interconnecting the primary opening with the diaphragm side of the face mask.

The embodiment described above is one in which all the pressure is maintained in the cannisters until such a time as the operating knob is 20 turned. An embodiment will now be described in connection with Figure 7 in which constant pressure is provided within the valve block body.

Referring to Figure 7 a valve block body 60 has a generally similar external appearance as the block 4 and includes an integrally formed externally screw-threaded boss 61, a primary opening 62 and an 25 enlarged diameter internally screw-threaded portion 63. Also, similarly to the block 4, a pair of opposed internally screw-threaded apertures 64 similar to the apertures 10 are provided for threadably mounting cannisters containing air or oxygen. Also similar to the block 4 a passageway 65 extends from the opening in which the cannisters are 30 located to the primary opening 62 so that a Y-shaped configuration of passageways is formed. However, unlike the body 4 a single 0.003 inch hole 66 extends axially through the boss 61 into the primary opening 62.

An O-ring seal 31 is mounted over the boss 61, the face mask 1 is also mounted over the boss 61 as is the further O-ring seal 33. The face 35 mask 1 is clamped in position by a locking collar 70 having an internal

screw thread 71 extending partially along the axis of the collar and on the opposite side from the internal screw thread 71 is a counter-bored portion 72 for receiving a filter 73 with is secured in position by a circlip 74. A 0.003 inch hole 75 permits air or oxygen to pass from the 5 screw thread opening 71 through the filter 73.

Rotatably mounted in the body 60 is a valve shaft 80 having a major diameter portion 81 in which are located a pair of opposed hard rubber seals 82 arranged to sealingly close the opposed passageways 62. The portion 81 is formed with a forward shaft 83 which is a running fit 10 in a bore 84 located intermediate the primary opening 62 and the hole 66. A slot 85 is provided in the shaft 83 and portion 81 to permit the passage of air or oxygen from passageway 65 through to the hole 66 and thence through filter 73. The valve shaft 80 has a tail shaft 86 on which is mounted an O-ring seal 87 and the seal 87 is clamped by an 15 externally screw-threaded plug 88 which mates with the thread 63. A control knob 89 is located over the shaft 86 and a grub screw 90 radially extends through the control knob 89 onto a reduced diameter portion 91 of the shaft 86.

When cannisters 6 are screwed into the body 60 the valves 20 20 thereof are depressed allowing air or oxygen to pass along the passageway 65 to the valve shaft 80, the seals 82 preventing air or oxygen escaping until the control knob 89 is rotated whereupon the air or oxygen passes along slot 85, through holes 66 and 75 and through the filter 73 into the mask.

25 The knob 89 is secured in a closed position of the valve to prevent escape of air or oxygen by a frangible wire locking device similarly to the embodiment described in Figures 5 and 6.

The procedure for use of the breathing apparatus is as follows:-

- 1) Remove the wire lock for the control knob.
- 30 2) Fit the mask over a person's nose and mouth.
- 3) Ensure that the straps 2, 3 hold the mask firmly.
- 4) Turn the control knob to allow air or oxygen to enter the mask.

It is expected that the foregoing operations will take between six and eight seconds and an expert decision will require to be made as to 35 the point in time at which the procedures should be implemented. The mask could be prepared and fitted just prior to impact in the instance of an aircraft accident, or alternatively after the impact but prior to

evacuation. In another alternative it may be desired that the wire lock should be broken, but the mask positioned on a person's head but not covering the mouth until the aircraft is at rest and then fitting the mask over a person's nose and mouth and turning the valve to an ON position. At sea, the above procedures may be performed just prior to immersion, and in this instance the apparatus would effectively prevent water entry to the lungs even though a bad entry into the water might cause exhalation.

It will be appreciated that the effective life of the device in use depends on the compression allowed in the cannisters and present technology allows the production of small cannisters capable of very high pressures, such as the cannisters used in soda syphons. Dependent on the pressures allowed by the relevant authorities and safety standards that are dictated so the effective life of the device in an emergency is determined, such requirements will also determine the type of valve that should be used; the simplest type of valve is a restrictor valve, which by orifice size allows only a set pressure drop in the cannisters over a specific time period but a more complex pressure reducer and demand valve would extend the life of the apparatus but increase the cost thereof.

CLAIMS:

1. A breathing apparatus for a person comprising a valve means arranged to at least partially support at least one pressurised cannister of a life supporting medium, said valve means also being arranged to support a face mask for admitting said medium to a person wearing said
5 face mask.
2. A breathing apparatus as claimed in claim 1 wherein said valve means is arranged to at least partially support a pair of cannisters, one on each side of said mask.
3. A breathing apparatus as claimed in claim 1 or 2 wherein a pocket
10 type aperture is provided on each side of said mask for receiving and additionally supporting a respective cannister.
4. A breathing apparatus as claimed in any preceding claim wherein securing means are provided for attaching said face mask to a person.
5. A breathing apparatus as claimed in any preceding claim wherein
15 said face mask is mounted on an integral boss of said valve means.
6. A breathing apparatus as claimed in any preceding claim wherein the valve means comprises a block member for receiving the cannisters in an air tight fashion, said block member having means for supporting said
20 face mask and a passageway extending from each cannister, provided in use, to said face mask, and an opening means for predeterminedly admitting said medium to the passageways.
7. A breathing apparatus as claimed in claim 6 wherein said
passageway is a Y-shaped configuration with the arms of the Y extending to a respective cannister and the leg thereof extending to the face
25 mask.
8. A breathing apparatus as claimed in claim 6 or 8 wherein the opening means comprises a manually rotatable member connected to rotate a pair of cam driven members which, in operation, when driven by said cam are arranged to displace said seal whereby said medium is admitted to
30 said passageways.
9. A breathing apparatus as claimed in claim 6 or 7 wherein the opening means comprises a manually rotatable member having a seal disposed for blocking said passageway, whereby upon rotation of said manually rotatable member the seals unblock the passageway and admit said
35 medium to said face mask.

10. A breathing apparatus as claimed in claim 9 wherein said manually rotatable member has a pair of channels each disposed between respective seals for providing a path for said medium to said face mask.
11. A breathing apparatus as claimed in any preceding claim wherein
5 said life supporting medium is compressed air or oxygen.
12. A breathing apparatus as claimed in any preceding claim wherein means are provided to lock the valve means in a closed position so that the medium cannot be passed to said face mask until manually unlocked.
13. A breathing apparatus as claimed in claim 12 wherein the means for
10 locking is a low breaking point wire arranged to normally prevent rotation of said manually rotatable member.
14. A breathing apparatus substantially as herein described with reference to and as shown in Figures 1 to 6, or Figures 1 to 4 and 7 of the accompanying drawings.

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